Assessment Part 1

Spyridoula Kasimati

Introduction

This project presents the process of mapping new enterprises created in London between 2004-2016 and the office spaces receiving planning permission in the same period, using R and ArcMap accordingly. The study begins by introducing the data sources, then demonstrates and compares the workflows and limitations of each map.

Data

The number of new enterprises in London were part of a business demographic dataset from the Office of National Statistics. Birth of enterprises was identified as the registration of a business which did not exist the year before. Data on planning permissions by development type was provided by the Greater London Authority. Accuracy on the attributes (Pepijn van Oort 2006) was established through the metadata, which explained the developments' classification, aiming to reduce the MAUP(David Wong 2009). Finally, the shapefile for the London basemap (using the British National Grid) comes from the ONS geoportal.

R

A grid of four chloropleth maps was created, to compare the births of enterprises across London throughout the years.The input was a shapefile of the administrative boundaries and a csv file of business demographics in England. A strong asset of R is its **packages**. To start with, **"tidyverse"** saved time from manually removing text from numeric cells.

The original dataset was noticeably complicated and R made it easy to subset the dataframe, without editing the original csv file. Also, with the **grep()** function the London Boroughs were separated from the rest of the rows.

The last step was to create a SF keeping the necessary data and the geometry, by joining the London Boundaries and Enterprise dataframes, based on their common field "code". The benefit of packages such as **ggplot** was that it enabled to plot, style (**viridis** package) and change the map any time, by adding layers. Among other packages, with **"reshape2"** the dataframe was rearranged according to years, and **"gridExtra"** positioned elements in the grid, such as the north symbol. However, even in the case of dynamic maps, a setback noticed in the CLI was the user's inability to navigate and experience space, in a way that a GUI software can offer.

Code	Area	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
E09000001	City of London	1,175	1,305	1,225	1,305	2,005	1,790	1,730	1,780	1,900	2,300	2,610	4,965	4,850
E09000002	Barking and Dagenham	480	500	485	510	720	615	635	835	845	1,185	1,310	1,665	1,775
E09000003	Barnet	2,435	2,425	2,150	2,305	2,610	2,410	2,440	2,835	2,995	3,735	3,985	4,460	4,455
E09000004	Bexley	940	900	895	870	795	720	840	945	895	1,340	1,455	1,605	1,640
E09000005	Brent	1,800	1,740	1,565	1,750	1,950	1,685	1,630	1,915	1,975	2,515	2,585	2,895	3,020
E09000006	Bromley	1,590	1,500	1,515	1,750	1,540	1,320	1,475	1,580	1,670	2,080	2,190	2,340	2,420
E09000007	Camden	2,840	2,570	2,485	2,745	3,035	2,735	2,930	3,200	3,140	3,990	4,375	5,445	6,050
E09000008	Croydon	1,630	1,525	1,580	1,595	1,575	1,400	1,495	1,755	1,765	2,305	2,390	2,695	2,905
E09000009	Ealing	2,115	1,885	1,775	2,035	2,155	1,940	1,715	2,210	2,225	3,200	3,110	3,420	3,590
E09000010	Enfield	1,400	1,380	1,385	1,285	1,425	1,310	1,390	1,530	1,615	2,270	2,305	2,520	2,650
E09000011	Greenwich	975	1,000	940	995	1,045	920	1,060	1,215	1,250	1,740	1,690	2,260	2,225
E09000012	Hackney	1,445	1,360	1,330	1,520	1,740	1,510	1,570	1,970	2,140	2,845	3,245	4,105	4,670
E09000013	Hammersmith and Fulham	1,865	1,745	1,470	1,785	1,960	1,560	1,640	1,830	1,885	2,290	2,380	2,560	2,350
E09000014	Haringey	1,345	1,285	1,130	1,270	1,425	1,275	1,325	1,570	1,500	2,110	2,190	2,350	2,415
E09000015	Harrow	1,370	1,325	1,200	1,310	1,435	1,455	1,470	1,605	1,730	2,170	2,390	2,605	2,710
E09000016	Havering	1,055	895	885	990	1,090	955	890	1,005	1,085	1,460	1,485	1,720	1,845
E09000017	Hillingdon	1,215	1,105	1,165	1,220	1,395	1,230	1,190	1,520	1,495	1,920	2,075	2,310	2,490
E09000018	Hounslow	1,310	1,325	1,175	1,360	1,510	1,310	1,415	1,885	1,820	2,210	2,320	2,525	2,615
E09000019	Islington	1,870	1,890	1,640	1,800	1,940	1,665	1,730	2,180	2,335	3,400	3,715	5,470	3,800
E09000020	Kensington and Chelsea	1,660	1,490	1,445	1,585	1,645	1,450	1,620	1,665	1,685	2,095	2,165	2,355	2,305
E09000021	Kingston upon Thames	880	865	850	1,025	1,025	905	885	985	980	1,185	1,270	1,370	1,410
E09000022	Lambeth	1,850	1,580	1,520	1,930	1,855	1,445	1,555	1,945	4,255	5,115	5,570	3,425	3,120
E09000023	Lewisham	1,135	1,070	1,065	1,230	1,290	1,030	985	1,350	1,415	1,825	1,870	2,045	2,095
E09000024	Merton	1,205	1,200	1,240	1,330	1,370	1,085	1,215	1,505	1,530	1,945	1,995	2,225	2,160

Metadata | Regional Enterprise Indices | **Enterprise births by year** | Enterprise deaths by year | Active Enterprises by year | 2002 Survival Rates | …

Figure 1: Initial dataset, before cleanup and subsetting

|	code1	Area	variable	value	geometry
27	E09000027	Richmond upon Thames	2004	1475	list(list(c(523109.3, 523126.6, 523132.9, 523166.1, 523161, …
28	E09000028	Southwark	2004	1945	list(list(c(532226.7, 532243.2, 532244.3, 532264.5, 532293, …
29	E09000029	Sutton	2004	855	list(list(c(527321.8, 527323.6, 527327.8, 527340.1, 527352, …
30	E09000030	Tower Hamlets	2004	1855	list(list(c(536779.3, 536780, 536799.9, 536822.6, 536859.9, …
31	E09000031	Waltham Forest	2004	1130	list(list(c(537921.1, 537947.5, 537965.4, 537940.2, 537922.…
32	E09000032	Wandsworth	2004	2630	list(list(c(530053.1, 530067.4, 530076.8, 530098.3, 530145.…
33	E09000033	Westminster	2004	5850	list(list(c(526735.2, 526772.7, 526876.7, 526954, 527045.2, …
52	E09000001	City of London	2008	2005	list(list(c(532140.3, 532141.5, 532142.4, 532146.6, 532158.…
53	E09000002	Barking and Dagenham	2008	720	list(list(c(548881.8, 548881.2, 548997.2, 549000.4, 549019, …
54	E09000003	Barnet	2008	2610	list(list(c(524579.9, 524594.3, 524607.4, 524619.1, 524630, …
55	E09000004	Bexley	2008	795	list(list(c(547801.8, 547927, 547948.8, 547954.4, 547961.8, …
56	E09000005	Brent	2008	1950	list(list(c(520284.7, 520319.4, 520347.8, 520383.4, 520432.…
57	E09000006	Bromley	2008	1540	list(list(c(541382.1, 541389, 541390.3, 541396.7, 541410.6, …
58	E09000007	Camden	2008	3035	list(list(c(527180.7, 527198.7, 527203.3, 527211.5, 527221.…
59	E09000008	Croydon	2008	1575	list(list(c(531442.9, 531471.7, 531501.1, 531509.9, 531516.…
60	E09000009	Ealing	2008	2155	list(list(c(515000.1, 515000.1, 515026.9, 515076.6, 515106.…

Figure 2: Final dataframe for faceted plot
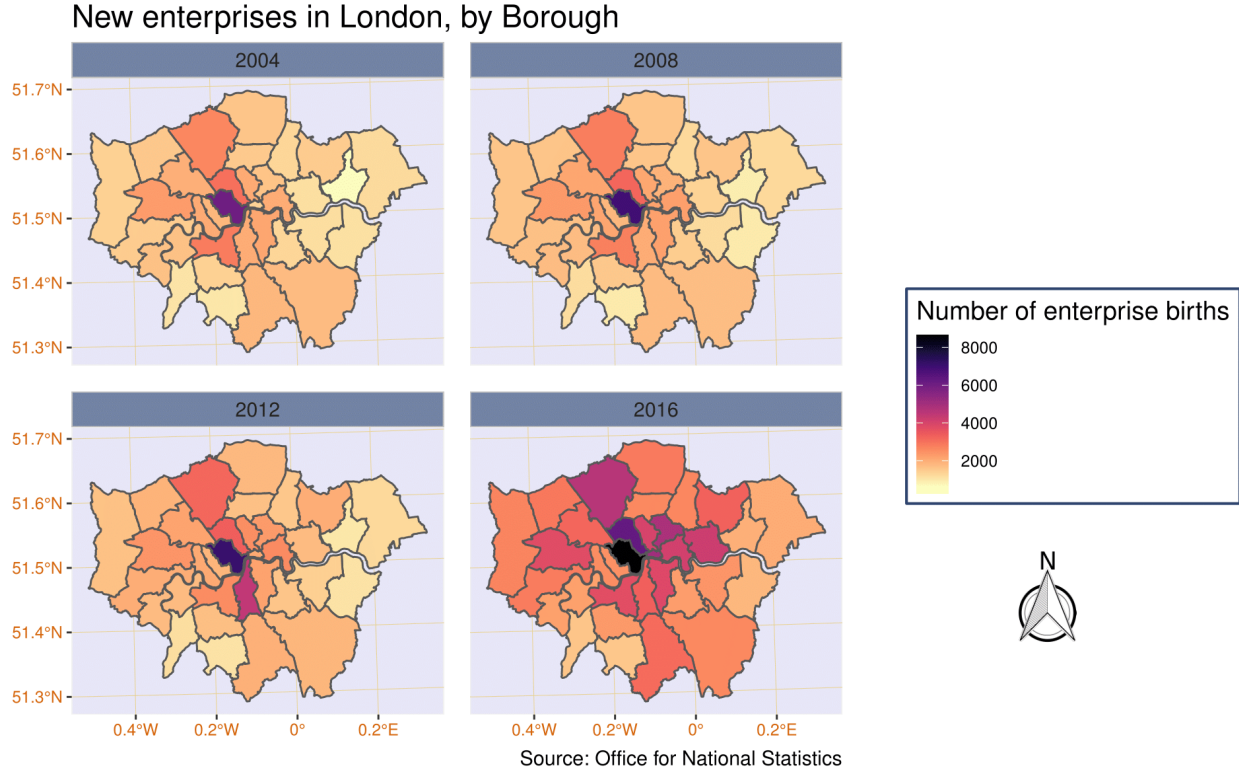
Figure 3: Final output using R.

ArcGis

The map presents the location and area of business offices, receiving planning permission between 2004-2016 in London. Considering that an object's attribute is better understood when presented within a context of other attributes (Paul Longley et al. 2015), the map depicts additionally the rest of permission types using purple dots.

Unlike R, the permissions data was cleaned externally in excel. After adding the data in ArcMap, a **feature class** of the total permissions was created. Using the "selection by **attributes**", a new feature class was created, exclusively for the business offices. The display properties of each class could be accessed from the contents table. It is noticeable that unlike CLI, ArcGiS made navigation in multiple files easy and provided a clear understanding of hierarchy through the ArcCatalog and the table of contents.

To visualize the area variations, ArcMap offered ready to use **symbology** options, easier to apply than those of CLI. In this case, the office area was illustrated with different sized bubbles. Given that there was a considerable values variation, the jenks classification was used (Michael J de Smith, Michael F Goodchild, and Paul A Longley 2018).Regarding the layout, ArcMap provided a greater freedom on positioning and adding complementary elements such as captions.
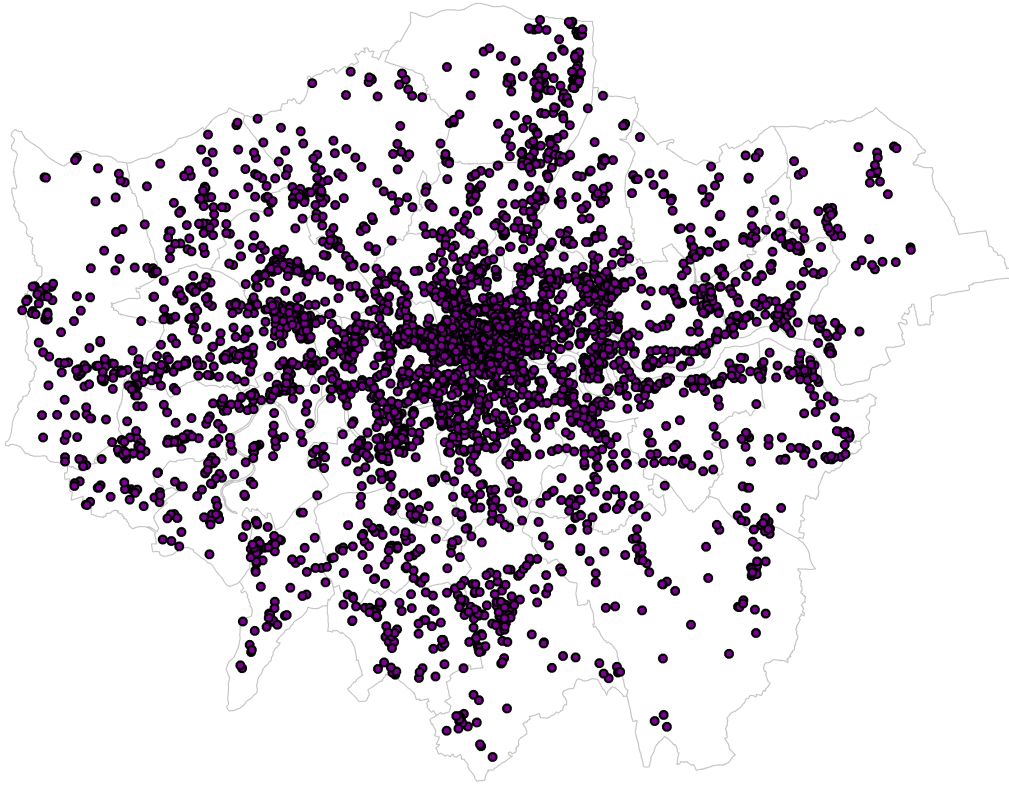
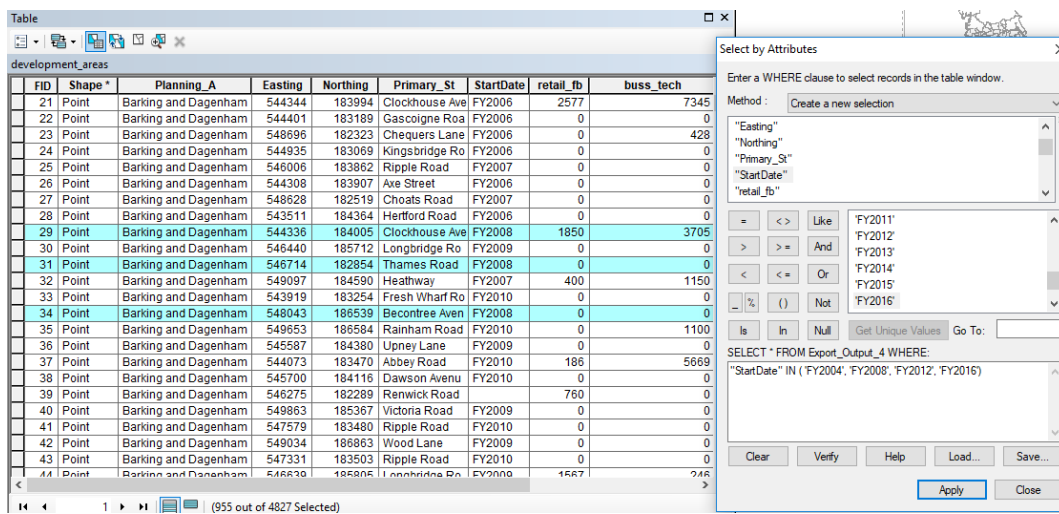Figure 4: Sample plot of total planning permissions, as points diplayed from XY data.

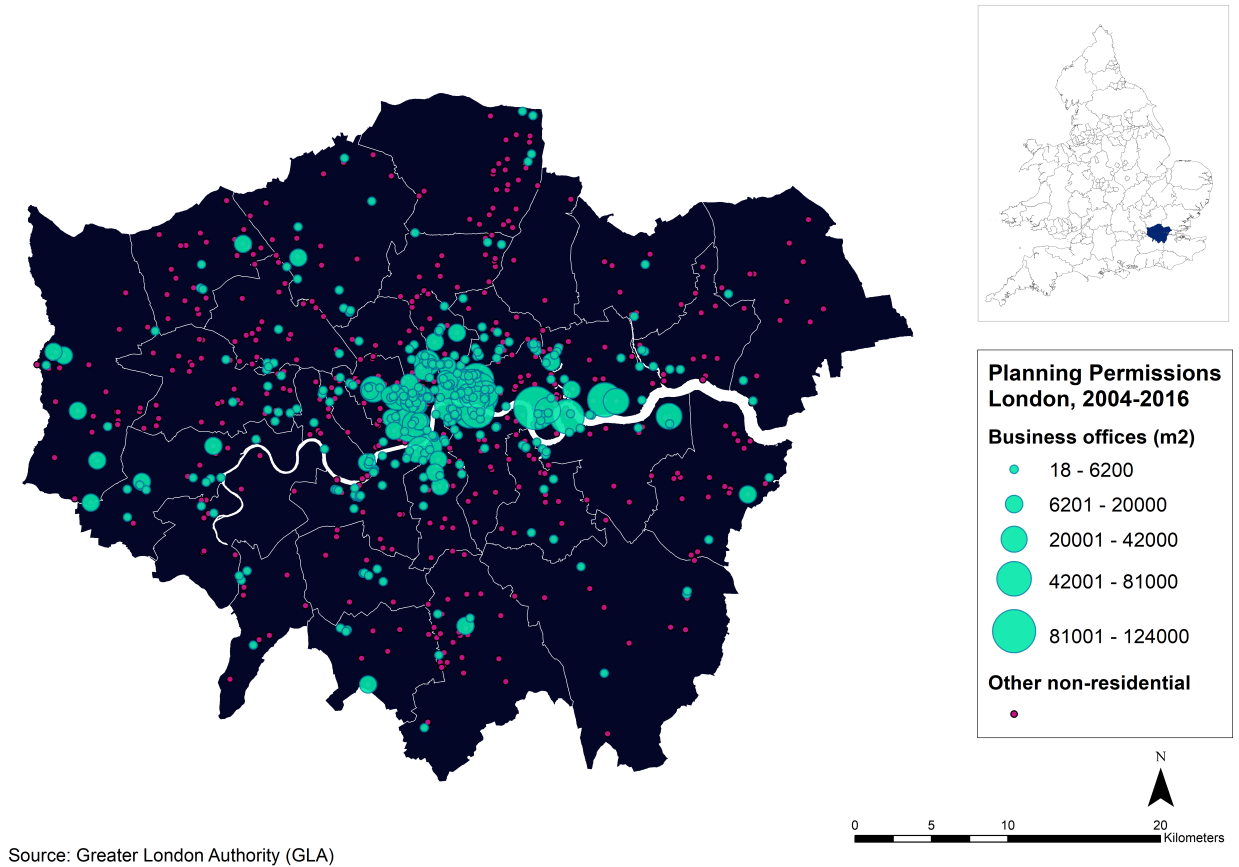Figure 5: Selection by multiple attributes (data for years 2004,2008,2012,2014)

Source: Greater London Authority (GLA)

Figure 6: Final output using ArcMap

Conclusion

Mapping in R entails great possibilities, evolving through packages created by its own users and having an extended support community. GUI software like ArcMap may lack the creative possibilities of CLI but provide a friendlier interface, promoting better interaction between the user and the space which the map addresses.

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